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Author Affiliation:

Bo Hou*[1], Ph.D., James Nazroo[234], Ph.D., James Banks[56], Ph.D., Alan Marshall[7], Ph.D.

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[1] National School of Development, Peking University, Beijing, China. 100871 Bo.Hou.07@gmail.com
[2] Sociology, School of Social Sciences, the University of Manchester, Oxford Road, Manchester. M13 9PL. UK
[3] Manchester Institute for Collaborative Research on Ageing, School of Social Sciences, the University pf Manchester, Oxford Road, Manchester. M13 9PL. UK
[4] Cathie Marsh Institute for Social Research, School of Social Sciences, Manchester. M13 9PL. UK
[5] Economics, School of Social Sciences, the University of Manchester, Oxford Road, Manchester. M13 9PL. UK
[6] The Institute for Fiscal Studies, 7 Ridgmount Street, London. WC1E 7AE
[7] School of Social and Political Science, University of Edinburgh, Edinburgh, UK

Abstract

Background

Urbanisation in developing countries is usually accompanied by migration to cities, making it a challenge to unpack the independent association between migration and health and urbanisation and health, particularly in the presence of health selective migration. Since 1978, unprecedented (planned) urbanisation has taken place in China and further increases to the urban population are expected. This paper explored the impacts of urbanisation in China through a comparative study of in-situ urbanised population.

Methods

Using the China Health and Retirement Longitudinal Study (CHARLS), a nationally representative dataset for people aged 45 years or older, we compared self-assessed general health, depressive symptoms and waist circumference among three groups: i. in-situ urbanised-rural residents, ii. rural residents and iii. urban residents. Using a model informed by the literature on the social determinants of health in later life, we investigated the patterning and drivers of differences in health outcomes between these three groups in order to explore the impact of urbanisation independent of the impact of migration.

Results

There are consistent advantages in health and less depression of urbanised-rural residents compared with the rural group; and this group has even better health outcomes than the urban group after adjusting for early-life differences. However, this relationship is reversed for waist circumference. Socioeconomic circumstances and factors related to a planned-urbanisation partly explain these effects.

Conclusions

Urbanisation in China has, on average, had an independent and positive effect on health and well-being. Planned-urbanisation could benefit people's health in developing countries. It is likely that improved infrastructure is a key driver.

Keywords

Urbanisation, self-reported health, depression, obesity, China, rural-to-urban migration

Key Messages

- This paper finds that urbanisation in China is associated with improved self-reported health and lower levels of depression.
- This impact of urbanisation is independent of the impact of migration that has been noted in the literature in China and elsewhere.
- The results add to a literature that suggests that planned-urbanisation could benefit population health and well-being in countries such as China.
- It is likely that improved infrastructure in urban areas is a key driver of the observed health advantages for in-situ urbanised rural residents.
- However, residents in urban areas also experience higher levels of obesity.

Introduction

Urbanisation in developing countries has been associated with economic development, employment opportunities, improvement in infrastructure and access to better health facilities, all of which are thought to lead to improved health outcomes. (1-4) On the other hand, rapid, unplanned and unregulated urbanisation in developing countries is also associated with a range of factors that are harmful to health and mental health including environmental hazards, such as air pollution and water pollution, poor quality housing, lack of sanitation, road-traffic injuries and traffic noise. (2, 5-13) In addition, urbanisation is also associated with increasing consumption of processed and energy rich foods and a sedentary lifestyle; these factors can lead to obesity which is associated with higher risks of suffering from diabetes, hypertension and heart disease. (10, 14-21) Thus, theories on the impact of urbanisation on health, and health-related outcomes, in developing countries is controversial, findings vary according to the particular context and the health outcome considered.

Urbanisation has occurred very rapidly in China. Following market liberalisation, the urban population of China has increased from 17.9% in 1978 to 51.3% in 2011 and the number of cities with a population of at least 500,000 has increased from 40 to 140 over this period, (22) with further projected increases under current government policies. (23) Urbanisation in China is almost entirely managed by the state, unlike urbanisation in other countries. As a result, this process has not created the urban slums which are common features of urbanisation in many countries, (24) such as India. (25) Urbanisation in China can also include forced urbanisation, involving involuntary relocation from sub-standard rural dwellings to higher standard housing in newly

created towns. (26) Forced urbanisation is associated with a set of positive changes that flow from better housing quality, but it is also thought to relate to problems including disrupted social networks and psychological stress associated with city life which may bring negative consequences for health and wellbeing. (27) Although urbanisation in China is associated with a number of public health challenges noted above, (4, 24, 28-33) in general those who move to urban areas have better health outcomes than the populations they leave behind. (34, 35) However, those who move are a selective sample in terms of their own health, wealth and other unobserved characteristics that may protect against experiencing adverse health outcomes in the future. (34-37) It remains unclear then, whether the extent to which the health advantage observed in urban areas is due to contextual characteristics of cities, or, simply a consequence of health-selective migration.

The speed, scale and planned nature of urbanisation in China offers a valuable opportunity to investigate the impacts of urbanisation on health. We do this by using a nationally representative dataset of older Chinese people to conduct a comparative study of the health outcomes of the in-situ, involuntarily, urbanised population, who live in once rural areas that have been absorbed by expanding urban areas. This in-situ urbanised-rural population group is distinct from those who have always lived in rural or urban locations for the whole of their lives. By studying the differences between these groups, we isolate the effect of urbanisation on health and wellbeing independent of selective migration to urban areas. Given the timing and pace of urban change in China, the urbanised group of people share early-life experience with the rural population and later-life experiences with urban dwellers.

Under the hypothesis that cities are good for health and that early-life advantage predicts late-life health, this would lead to four empirical predictions which we explore in this paper, namely: 1. The health and wellbeing of the in-situ urbanised population will be (a) better than that of the rural group, and (b) worse than that of the urban group –perhaps with the exception of cardiovascular or chronic diseases where we might expect the effect to be reversed due to lack of exercise and obesogenic diets in urban areas; 2. The health advantage compared with the rural population will not be a consequence of characteristics that could be related to selection; 3. Individual economic mobility occurring as a consequence of urbanisation, will be part of the explanation; 4. The development of urban infrastructure will contribute to this advantage.

Methods

This paper uses the China Health and Retirement Longitudinal Study (CHARLS), a nationally representative, multi-disciplinary and public dataset, that aims to capture the health and well-being of the Chinese population aged 45 and over. (38) The nature of CHARLS is multi-disciplinary; it contains detailed information of respondents' social, economic and health conditions. Further details on the sample are provided elsewhere. (39) This paper uses the CHARLS national baseline survey which was conducted between June 2011 and March 2012. The national baseline survey comprises information on about 17,000 individuals and 10,000 households. Our reasons for choosing the CHARLS baseline survey are: first, the CHARLS sample of older adults contains sufficient members of people who have been through the urbanisation process which surveys of younger cohorts may not; second, the CHARLS includes detailed

information on individuals' socioeconomic circumstances and health including early-life circumstances.

Precise definitions and measures of urbanisation vary. (40) However, there is agreement that urbanisation reflects a growing proportion of people who live in cities (or urban areas). In this paper, we use the CHARLS classification of an urban area from the National Bureau of Statistics in China, which states a community is urban if it is located in a city, suburb of a city, a town, or other special areas, where non-farming employment constitutes at least 70% of the work force. Rather than a purely administrative definition, this definition also captures some information on economic activity, which is an important part of the urbanisation process.

To capture impacts of urbanisation, this paper compares in-situ urbanised-rural residents with rural and urban residents (N=12,916). To do this, we first remove migrants and return migrants from the sample, using data on their current place of residence, birthplace and lifetime migration records of longer than six months. We then use Hukou status to identify in-situ urbanised-rural residents. The Hukou system is a unique feature in China that is loosely similar to an internal passport system; there are two types of Hukou, an agricultural type and a non-agricultural type; this classification is based on the rural/urban classification of a person's birthplace. (41) This allows us to separate out urban non-migrants by their Hukou status, so we have urban non-migrants with an urban Hukou and urban non-migrants with a rural Hukou. As the Hukou type (agricultural/non-agricultural) is a marker relating to birthplace, urban non-migrants with a rural Hukou are likely to be a group of rural people who experienced

cities being built around as part of the rapid urbanisation in China. The utility of the urbanised-rural group is that the impact of urbanisation on them is likely to be exogenous to health outcomes.

Empirical Model

The outcome variables are self-assessed health status (five categories) and depression scores that are calculated based on the 10-item Center for Epidemiological Studies Depression Scales (CESD)-10 items. (42, 43) Studies have shown that these health outcomes are useful markers of population health, including in terms of predicting future events such as hospital admission, mortality and various clinical outcomes. (44-47) Both outcome variables were analysed with the ordinary least squares (OLS) regressions with lower values of these variables indicative of better health. Multinomial logit regressions were used to confirm the robustness of the result from the OLS models predicting self-assessed health status. To address the possibility that urbanisation relates to growing obesity in China, we also use waist circumference, an objective measure, as an indicator for obesity. (48) In the studied population, the mean and standard deviation of self-reported health status are 3.03 and 0.92. These statistics are 8.60 and 6.39 for depression scores and are 84.13 and 12.37 for waist circumference.

This paper uses an empirical model that builds on the literature on social determinants of health in later life. In this model, we control for demographic, early-life, socioeconomic, psychosocial and behavioural factors that relate to health and well-being in later life. (49) To this model, we add an assessment of physical exercise to explore the possibility that urbanisation may relate to changes to a more sedentary lifestyle. This physical activity variable is only available from a random half of the

sample in the CHARLS. Furthermore, to indicate the presence of urban infrastructure, a flushable toilet variable is included to capture whether a sewage system in place. This variable has three categories: no toilets in the household, non-flushable toilets and flushable toilets. For early-life factors, in addition to education and first job, we also include lower leg length (knee height), which is used as an objective measure of youth and childhood health and socioeconomic circumstances. (50)

Table S1 in the supplementary material shows the means of variables with stratification by residential status. The urban group were less likely to have no education, less likely to be farmers and had greater knee height; while, encouragingly for our study design, the rural and urbanised-rural groups were similar on these early-life factors. For instance, in terms of the first job, 92% of the rural group were farmers compared with 84% of urbanised-rural group; whereas the proportion for the urban group is 28%. However, there are larger differences between the rural and urbanised-rural groups in terms of current socioeconomic variables. For instance, the average of estimated value for the household durable wealth is 6,470 yuan for the rural group, 9,520 yuan for the urbanised rural, and 11,460 for the urban group. In terms of the marker of the urbanisation effect, more than twice the number of urbanised-rural households have a flushable toilet compared with rural households (47% vs 22%), while this figure is even higher for the urban group at 72%.

To address hypothesis 1a and 1b, we show a model controlling for age and gender. To address hypothesis 2, we show a model adjusting for early-life factors and the extent to which they contribute to the advantage of urban people. Hypothesis 3 is tested by

including individual socioeconomic indicators. At this stage of the model we also control for familial support and smoking and drinking behaviours. To address hypothesis 4, we include the indicator of urban infrastructure, having a flushable toilet in the house. We use a sequence of regressions; gradually adding in each cluster of factors from the empirical model to the previous regression model. We have truncated the sample at age 80 to avoid concerns of acute selective mortality (about 3% of the CHARLS sample are over this age and hence excluded from our analysis). Robust standard errors are used in all regressions to allow for heteroskedasticity in residuals and to ensure that appropriate statistical inferences are drawn. Analyses were conducted using STATA 14 (StataCorp, College Station, TX, USA). Full results and results of multinomial logit regressions are in the supplementary material.

Results

Charts 1-3 depict the mean of self-assessed health status, depression scores and waist circumference respectively for the three groups. 95% confidence intervals are included in these charts. These charts indicate that the urbanised-rural group has better average health status and depression scores compared with the rural group, whilst experiencing worse scores compared with the urban group. However, the average waist circumference of urbanised-rural group is smaller than the urban group and is larger than the rural group. These results hold for both men and women. The interaction term of gender by residential status is not statistically significant.

Table 1 shows the results of linear models for self-assessed health status. The rural group has worse health status compared with the urbanised-rural group (which takes

the reference category) and this differential is consistent across all specifications as control variables do not meaningfully attenuate this relationship until specification 5 of the model. For instance, the coefficient for the rural group is 0.165 ($p<0.001$) after adjusting for age and sex in specification one, and becomes 0.158 ($p<0.001$) after controlling for early-life factors in step two. In subsequent models, the coefficient stays around this level across all the later model specifications. The rural versus urbanised-rural differential holds even after controlling for the physical exercise variable in step 4, which is based on a half-random sample. The exception to this is after controlling for the flushable toilet in specification 5. This coefficient for the rural is 0.147 ($p<0.001$) in step 4 (controls for demographic, early-life and socioeconomic factors) and attenuates by 18% to 0.121 ($p<0.001$) in step 5. Furthermore, there is no statistically significant difference in having a non-flushable toilet compared with having no toilet in the household, see the full table in the supplementary material. The results of multinomial logit regressions also confirm this consistent health advantage of the urbanised-rural group.

The results for depression scores in table 2 show similar findings: the presence of statistically significant and consistent advantage in lower depression scores for the urbanised-rural group compared with the rural group; and the only control variable that attenuates this relationship is having a flushable toilet in the household. In this table, the coefficient for the rural group is 1.457 ($p<0.001$) after controlling for age and sex. After controlling for the differences in early-life factors in specification 2, this coefficient attenuates by 10% to 1.307 ($p<0.001$). This coefficient largely stays around this level in later specifications, but it drops by almost 30% from step 3 (1.075, $p<0.001$) to step 5 (0.75, $p<0.001$), which controls for the flushable toilet. Again, it is having the

flushable toilet in the household, as a proxy for improved infrastructure in urban areas, that makes the most difference in explaining the advantage of the urbanised-rural group compared to their rural counterparts.

The advantage in health outcomes associated with the urbanised-rural group is also clear when compared to the urban group after adjusting for compositional differences in early-life factors. For instance, in table 2 for the depression models, after adjusting for age and sex, the coefficient for the urban group is -0.798 ($p<0.001$) compared with the urbanised-rural group, indicating better mental health for urban dwellers. This coefficient becomes 0.656 ($p=0.018$) after adjusting for differences in early-life factors in specification 2. After socioeconomic factors are entered into the model in step 3, this coefficient becomes 0.827 ($p=0.003$). A similar magnitude of effect persisted throughout the later models in this table with a coefficient estimate of 0.905 ($p=0.001$) in the fully adjusted model. There is little difference in the self-reported health of the urban and urbanised-rural groups in the baseline model. However, a modest health advantage emerges once early-life circumstances are accounted for.

Table 3 presents results on waist circumference. After adjusting for age and sex in step 1, the average waist circumference of the rural group is 2.643 cm ($p<0.001$) smaller than urbanised-rural group. This difference changes slightly after adjusting for early-life factors. After adjusting for socioeconomic factors, this coefficient reduces by a quarter to -1.998 ($p<0.001$), indicating that this differential relates partly to socioeconomic advantage in urban areas. However, after accounting for differences in exercise in step 4, this coefficient increases to -2.331 ($p<0.001$). After adjusting for the

flushable toilet, this coefficient is estimated at -2.008 ($p<0.001$). In addition, the urban group has a bigger waist circumference compared with urbanised-rural group. For instance, the average waist circumference of urban group is 2.194 cm ($p<0.001$) larger than the urbanised-rural group after controlling for demographic factors. But this difference is explained after adjusting for differences in early-life and socioeconomic factors.

Discussion

The literature and theoretical perspectives on urbanisation and health in developing countries are mixed. (1, 2, 5, 17) In a context of rapid global urbanisation, this is an important area of uncertainty. On the one hand the process of urbanisation is thought to be associated with improvement in infrastructure and socioeconomic circumstances that lead to improved health outcomes. Yet, on the other hand, scholars point to poorer health outcomes that may be linked to environmental pollution and unhealthy lifestyle choices. This paper investigates the impact of urbanisation on health and well-being in China by studying an empirical model to examine health differences and possible causal pathways, developed from the literature on the social determinants of health in later-life. A key methodological issue in much of the research on urbanisation and health is that the improved health outcomes in urban area compared to rural regions might, at least in part, be a function of large-scale health-selective migration to urban areas rather than urbanisation itself; the characteristics that are conductive to migration from rural to urban areas are related to improved health across the life course. One key strength of this paper is that we are able to identify a population in China that experienced urbanisation in-situ, and compare them with those who remained in rural areas and

those who remained in urban areas across their lives, and can thereby investigate impacts of urbanisation independent of the influence of migration on health that have also been occurring over this period in China.

We find a positive effect of urbanisation on health and well-being in China. The urbanised-rural group have improved general and mental health outcomes compared with the rural group. Controlling for early-life factors and socioeconomic factors attenuates this relationship only slightly. However, controlling for the presence of a flushable toilet largely explains this effect. This variable reflects the construction of a sewage system, which may suggest that the effect is a consequence of a planned urbanisation process and associated improved infrastructure. When comparing the urban and urbanised-rural groups a health/wellbeing advantage emerges for urbanised-rural residents after accounting for early-life circumstances. In the Chinese context these urban health/wellbeing advantages seem to be sufficient to overcome the disadvantages of early-life that are more concentrated among those who grew up in rural areas.

As other studies have suggested, (24, 29) urbanisation in China appears to be associated with an increased risk of obesity as the urbanised-rural group have larger on average waist circumferences compared with the rural group. This may be due to the changes in lifestyles, e.g., less physical exercise and more obesogenic diets in urban areas. (24) The trend towards increased obesity in urban areas and the emergence of dietary risk factors as a leading risk factor accounting for disability-adjusted life-years and deaths (4) in China may alter urban/rural health differentials in the future. (51)

Other studies have directly tested the impacts of urbanisation on health in China. (29, 51, 52) These have measured urbanisation effects using an index, which includes factors such as community characteristics. The potential problem with this approach is that a range of different mechanisms may be at work for the relationship between these underlying community characteristics and health. Thus, the particular mechanism through which urbanisation affects health is unclear from these studies. Additionally, and perhaps more importantly, these studies have failed to address migration processes, which account for a large share of urban population growth in China, thus their results may be biased by factors related to selection into a migrant population.

There are a number of limitations in our analysis that should be acknowledged alongside our interpretation of the results. First, the urbanisation effect here may also be due to changes in income and the improvement in the health care system in China, both of which will relate to access to urban infrastructure. We do not directly test these here. Additionally, in this paper, we are unable to deal with the survival effect, where healthier people tend to survive longer than unhealthy individuals, and so we may have underestimated the differences in health status and depression scores and overestimated the differences in obesity. Finally, in this paper we focus on broad measures of health and wellbeing. Other specific health outcomes, such as conditions affected by air pollution that is a greater issue in cities, might be negatively related to urbanisation in China. (53)

Conclusion

In summary, our findings suggest that urbanisation in China has, on average, had an independent and positive effect on health outcomes, separate to the potential effect of health selective migration noted in the literature. The urbanised-rural and rural groups in our sample have very similar early-life circumstances giving confidence that our comparison of health across these groups is isolating the impact of urbanisation on health. The results show that effectively managed urbanisation could benefit people's health and well-being and that improvement in infrastructure is likely to be a key driver. (54)

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